

CLAIMS

What is claimed is:

1. A sonar beamforming system, comprising in combination:
5 a forward-looking sonar having transmit and receive transducer arrays and a
 beamforming device; and
 at least one side-looking sonar having multi-element arrays and a beamforming
 device.
- 10 2. The system of claim 1, further comprising a downward-looking sonar for high-resolution
 terrain and object identification.
3. The system of claim 1, wherein at least one of the forward-looking sonar and at least one
 side sonar are mounted on a pivotable motorized array.
4. The system of claim 1, wherein at least one of the forward-looking sonar and the side-
 looking sonar include multi-mode arrays for at least a detection mode and an
 identification mode.
- 20 5. The system of claim 1, wherein the system further comprises multi-element acoustic
 communication receive arrays.
6. A water craft, comprising in combination at least one of:
 a forward-looking sonar having a transmit and receive transducer array and a
25 beamforming device; and
 a side-looking sonar having multi-element arrays and a beamforming device.

7. A forward-looking sonar comprising in combination:
a bistatic transducer array having a first transmit transducer array and a second receive transducer array;
a beamforming device; and
a processing unit.
8. A method for forming an integrated image comprising the steps of:
obtaining array signals from a forward-looking sonar;
obtaining array signals from at least one side-looking sonar;
normalizing the array signals from the forward-looking sonar and the at least one side-looking sonar to generate normalized data; and
fusing the normalized data to generate an image.
9. An underwater unmanned vehicle system comprising in combination:
a forward-looking sonar having a transmit and receive transducer array and a beamforming device; and
at least one side-looking sonar having a second transducer array and a beamforming device.
10. The system of claim 9, further comprising a downward-looking sonar for high-resolution terrain and object identification.
11. The system of claim 9, wherein at least one of the forward-looking sonar and at least one side sonar are mounted on a pivotable motorized array.
12. The system of claim 9, wherein at least one of the forward-looking sonar and the side-looking sonar include multi-mode arrays for at least a detection mode and an identification mode.

13. The system of claim 9, wherein the system further comprises multi-element acoustic communication receive arrays.
14. The system of claim 9, wherein the beamforming device further comprises a plurality of charge domain delay lines.
15. The system of claim 9, wherein the beamforming device comprises a sampling circuit connected to a programmable delay circuit, a weighting circuit, and a summing circuit.
16. The system of claim 9, further comprising a memory circuit connected to the beamforming device.
17. The system of claim 16, further comprising an interface controller connected to the memory circuit.
18. The system of claim 17, further comprising a Firewire interface connected to the interface controller and the memory circuit, the Firewire interface communicating with a central processor.
19. The system of claim 9 wherein the beamforming device comprises a charge domain delay line.
20. The system of claim 19 further comprising a plurality of charge coupled device delay lines, each delay line having a programmable tap selection circuit.